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ANNOTATED BIBLIOGRAPHY ON BIOLOGY OF AMERICAN MENHADEN

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and RICHARD A. COLLINS

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ABSTRACT

A bibliography pertaining to the biology of the menhaden, genus *Brevoortia*, including the seven species reported from North and South American waters. Included are references occurring in scientific or technical literature and duplicated reports of established series published before and during 1957. Brief annotations and a subject index are included.

ANNOTATED BIBLIOGRAPHY ON BIOLOGY OF AMERICAN MENHADEN

By JOHN W. REINTJES, *Fishery Research Biologist*, JAMES Y. CHRISTMAS, JR., *Marine Biologist*, and RICHARD A. COLLINS, *Marine Biologist*, BUREAU OF COMMERCIAL FISHERIES

When biological studies of the Atlantic menhaden resource were undertaken in 1955 by the Menhaden Investigations of the U.S. Fish and Wildlife Service, and studies of the gulf menhaden resource in 1957 by the Gulf Coast Research Laboratory under U.S. Fish and Wildlife Service contract No. 14–19–008–9335, it was recognized that a review of the literature was fundamental in planning the research program. This bibliography was therefore prepared to assist investigators in the conduct of these studies.

The bibliography deals chiefly with the American menhaden, *Brevoortia tyrannus* (Latrobe), and the gulf menhaden, *B. patronus* Goode, the species of greatest importance to the menhaden industry of the United States. Three additional species occurring in North American waters are included: *B. smithi* Hildebrand, a distinct species of minor importance in the south Atlantic region; *B. gunteri* Hildebrand, a similar and distinct species of minor importance in the Gulf of Mexico; and *B. brevicaudata* Goode, a questionable species described from a single collection made at Noank, Conn., in 1874. Two additional species, *B. aurea* (Agassiz) and *B. pectinata* Jenyns, have been reported from the Atlantic coast of South America; the few references, pertaining to these species, that were available to the authors have been included.

Two genera, *Ethmidium* Thompson from the Pacific coast of South America and *Ethmalosa* Regan from the Atlantic coast of Africa, although closely allied to the menhaden, have not been included unless reported as *Brevoortia*.

In review of the literature, certain criteria were used to distinguish references that were to be included from those that were to be excluded from the work. In general, references pertaining to distribution, occurrence, abundance, life history, morphology, ecology, and behavior were included. References concerned with the technological aspects of the fishery and the reduction industry; daily, monthly, or annual landing reports and statistics; and popular accounts in trade journals, newspapers, and magazines generally were excluded. Included are references occurring in scientific and technical literature published before and during 1957. A few references published in 1958 have been included. Generally, administrative or project progress reports have been omitted. Mimeographed or similarly duplicated reports of an established series, when principally concerned with the menhaden, have been included.

Literature respecting the menhadens contains relatively few major contributions. Many of the references make only a brief mention or listing of the species, but since the name often occurs in an index it was considered advisable to include all entries, with annotations, to guide the investigator.

The arrangement of the references is by authors, listed alphabetically. If there is more than one author, entry is made only under the senior author's name. Each author's works are listed chronologically by year of publication, and those published in the same year are given alphabetical sequence by title. Generally, pagination is given only for the parts of the publication falling within the scope of the bibliography furnishing information on the extent of the reference material. Very brief annotations of the contents of the publications are included except those whose titles give a clear indication of the contents. Because the majority of the references concern the Atlantic menhaden, or menhaden generally, annotations on species are given only when species other than *B. tyrannus* are concerned.

Acknowledgement is made of the assistance given the authors by the library staffs of the Department of the Interior, U.S. National Museum, Library of Congress, Tulane University, New Orleans Public Library, and the University of Texas, and staff members of the Marine Laboratory of the Texas Game and Fish Commission, Rockport, Tex., Gulf Fishery Investigations, Galveston, Tex., and U.S. Fishery Laboratory, Beaufort, N.C.

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LIST OF ABBREVIATIONS OF PERIODICAL TITLES

Amer. Fish. Soc. Spec. Publ.—American Fisheries Society, Special Publication. Ann Arbor.

Amer. Jour. Physiol.—American Journal of Physiology. Baltimore.

Amer. Midl. Nat.—American Midland Naturalist. Notre Dame.

Amer. Month. Mag and Crit. Rev.—American Monthly Magazine and Critical Review. New York.

Amer. Mus. Nat. Hist.—American Museum of Natural History. New York.

Amer. Nat.—The American Naturalist. New York.

Anal. Mus. Nac. Buenos Aires—Anales Museo Nacional de Historia Natural de Buenos Aires. Buenos Aires.

Ann. Mag. Nat. Hist.—Annals and Magazine of Natural History. London.

Ann. Rept. Dept. Mar. Fish. Canada—Annual Report of the Department of Marine Fisheries of Canada. Ottawa.

Ann. Rept. N.J. State Mus.—Annual Report of the New Jersey State Museum. Trenton.

Ann. Rept. N.Y. Comm. Fish.—Annual Report, New York Commissioner of Fisheries. Albany.

Ann. Rept. N.Y. Cons. Dept.—Annual Report of the New York Conservation Department. Albany.

Ann. Rept. N.Y. Forest, Fish and Game Comm.—Annual Report of the New York Forest, Fish and Game Commission. Albany.

Ann. Rept. N.Y. State Mus.—Annual Report New York State Museum. Albany.

Ann. Rept. R.I. Comm. Inl. Fish.—Annual Report of the Rhode Island Commissioner of Inland Fisheries. Providence.

Ann. Rept. Smithsn. Inst.—Annual Report of the Smithsonian Institution. Washington.

Arq. Zool. Sao Paulo—Arquivos de Zoologia do Estado de São Paulo. São Paulo.

Biol. Bull.—Biological Bulletin. Marine Biological Laboratory. Woods Hole.

Bost. Jour. Nat. Hist.—Boston Journal of Natural History. Boston.

Bull. Amer. Mus. Nat. Hist.—Bulletin of the American Museum of Natural History. New York.

Bull. Bingham Oceanogr. Coll.—Bulletin of the Bingham Oceanographic Collection. Yale University. New Haven.

Bull. Fla. State Mus.—Bulletin of the Florida State Museum. Gainsville.

Bull. La. Dept. Cons.—Bulletin of the Louisiana Department of Conservation. New Orleans.

Bull. Mus. Comp. Zool.—Bulletin of the Museum of Comparative Zoology. Harvard College. Cambridge.

Bull. N.Y. State Mus.—Bulletin of the New York State Museum. Albany.

Bull. Soc. Cent. Aquic. Peche.—Bulletin de la Societé centrale d'aquiculture et de Pêche. Paris.

Bull. Tex. Game, Fish and Oyster Comm.—Bulletin of the Texas Game, Fish and Oyster Commission. Rockport.

Bull. U.S. Bur. Fish.—Bulletin of the United States Bureau of Fisheries. Washington.

Bull. U.S. Fish Comm.—Bulletin of the United States Fish Commission. Washington.

Bull. U.S. Natl. Mus.—Bulletin of the United States National Museum. Washington.

Canad. Nat.—Canadian Nature. Toronto.

Canad. Nat. and Geol.—Canadian Naturalist and Geologist. Ottawa.

Chesepeake Biol. Lab. Publ.—Chesapeake Biological Laboratory, Publication. Maryland Department of Research and Education. Solomons.

Comm. Fish. Rev.—Commercial Fisheries Review. United States Fish and Wildlife Service. Washington.

Cons. Bull. U.S. Fish Wildlife—Conservation Bulletin, United States Fish and Wildlife Service. Washington.

Cons. Internat. Explor. de la Mer, Rapp. et Proc. Verb.—Conseil Permanent International pour L'exploration de la Mer, Rapports et Procès-Verbaux des Réunions. Copenhagen.

Contr. Canad. Biol.—Contributions to Canadian Biology. Canadian Biological Board. Toronto.

Ecol. Monogr.—Ecological Monographs. Ecological Society of America. Duke University Press. Durham.

Ecology—Ecological Society of America. Duke University Press. Durham.

Exp. Parasit.—Experimental Parasitology. Academic Press Inc. New York.

Fla. Bd. Cons. Educ.—Florida Board of Conservation and Education. Tallahassee.

Fla. State Mus.—Florida State Museum. Tallahassee.

Fish. Bull. U.S. Fish Wildlife—Fishery Bulletin, United States Fish and Wildlife Service. Washington.

Geogr. Rev.—Geographic Review. New York.

Great Int. Fish. Exhb.—Great International Fisheries Exhibit. London.

Hull Bull. Mar. Ecol.—Hull Bulletin of Marine Ecology, Hull University College, Hull.

Ill. Biol. Monogr.—Illinois Biological Monographs. Urbana.

Inv. Rept. U.S. Bur. Fish.—Investigational Report, United States Bureau of Fisheries, Washington.

Jour. Acad. Nat. Sci. Phila.—Journal of the Academy of Natural Sciences. Philadelphia.

Jour. Biol. Chem.—Journal of Biological Chemistry. Baltimore.

Jour. Elisha Mitchell Sci. Soc.—Journal of the Elisha Mitchell Scientific Society. Chapel Hill.

Jour. Mar. Biol. Assn. (U.K.)—Journal of the Marine Biological Association of the United Kingdom. Plymouth.

Jour. Parasitol.—Journal of Parasitology. Lancaster.

Jour. Wash. Acad. Sci.—Journal of the Washington Academy of Sciences. Washington.

Jour. Wildlife Mgt.—Journal of Wildlife Management. Washington.

La. Cons. Rev.—Louisiana Conservation Review. New Orleans.

Limnol. Oceanogr.—Limnology and Oceanography. American Society of Limnology and Oceanography. Baltimore.

Mar. Life Occ. Pap.—Marine Life Occassional Papers. New York.

Md. Cons. Bull.—Maryland Conservation Bulletin. Annapolis.

Mem. Amer. Acad. Arts Sci.—Memoirs of the American Academy of Arts and Science. Boston.

Miss. Seafood Comm.—Mississippi Seafood Commission. Biloxi.

Monogr. Acad. Nat. Sci. Phila.—Monographs of the Academy of Natural Sciences. Philadelphia.

Nat. Hist. Soc. Md. Bull.—Natural History Society of Maryland Bulletin. Baltimore.

Natl. Fish. Inst.—National Fisheries Institute. Washington.

N.C. Geol. Econ. Sur.—North Carolina Geological and Economic Survey. Raleigh.

N.Y. Cons. Dept.—New York Conservation Department. Albany.

N.Y. Fish and Game Jour.—New York Fish and Game Journal. Albany.

N.Y. State Dept. Cons.—New York State Department of Conservation. Freeport.

Occ. Pap. Boston Soc. Nat. Hist.—Occasional Papers of the Boston Society of Natural History. Boston.

Occ. Pap. Mar. Lab. La. State Univ.—Occasional Papers of the Marine Laboratory, Louisiana State University. Baton Rouge.

Occ. Pap. Mus. Zool. Mich.—Occasional Papers of the Museum of Zoology, University of Michigan. Ann Arbor.

Oceanogr. Inst. Fla. State Univ.—Oceanographic Institute of the Florida State University. Tallahassee.

Öfvers. Svensk. Vet. Akad. Förh.—Öfversigt af Svenska Vetenskapsakademien Förhandlingar. Stockholm.

Proc. Acad. Nat. Sci. Phila.—Proceedings of the Academy of Natural Sciences. Philadelphia.

Proc. Amer. Phil. Soc.—Proceedings of the American Philosophical Society. Philadelphia.

Proc. Biol. Soc. Wash.—Proceedings of the Biological Society of Washington. Washington.

Proc. Boston Soc. Nat. Hist.—Proceedings of the Boston Society of Natural History. Boston.

Proc. Central Fish Cult. Soc.—Proceedings of the Central Fish Cultural Society. Washington.

Proc. Gulf Carib. Fish. Inst.—Proceedings of the Gulf and Caribbean Fisheries Institute. Coral Gables.

Proc. Portland Soc. Nat. Hist.—Proceedings of the Portland Society of Natural History. Portland.

Proc. Trans. Nova Scotian Inst. Nat. Sci.—Proceedings and Transactions of the Nova Scotian Institute of Natural Sciences. Halifax.

Proc. U.S. Natl. Mus.—Proceedings of the United States National Museum. Washington.

Proc. Zool. Soc. London—Proceedings of the Zoological Society of London. London.

Publ. Inst. Mar. Sci.—Publication of the Institute of Marine Science. Port Aransas.

Quart. Jour. Fla. Acad. Sci.—Quarterly Journal of the Florida Academy of Sciences. Gainesville.

Rept. Maine Bd. Agr.—Report of the Maine Board of Agriculture. Augusta.

Rept. Mass. Comm. Fish.—Report of the Massachusetts Commissioner of Fisheries. Boston.

Rept. Md. Comm. Fish.—Report of the Maryland Commissioner of Fisheries. Annapolis.

Rept. U.S. Comm. Fish.—Report of the United States Commissioner of Fisheries. Washington.

Rept. U.S. Comm. Fish and Fisheries—Report of the United States Commissioner of Fish and Fisheries. Washington.

Rept. State Geol. N.J.—Report of the State Geologist of New Jersey. Trenton.

Sears Found. Mar. Res.—Sears Foundation of Marine Research, Yale University. New Haven.

Secy. Rept. Assn. Me. Oil and Guano Mfg.—Secretary's Report of the Association of Maine Oil and Guano Manufacturers. Portland.

Serv. Info. Agric. Brazil—Servico de informacao agricola Brazil. Rio de Janeiro.

Smithsn. Misc. Coll.—Smithsonian Institution Miscellaneous Collection. Washington.

Spec. Sci. Rept.: Fish. U.S. Fish Wildlife—Special Scientific Reports: Fisheries. United States Fish and Wildlife Service. Washington.

Stanford Ichth. Bull.—Stanford Ichthyological Bulletin, Leland Stanford Jr. University. Palo Alto.

Stud. Biol. Lab. Johns Hopkins U.—Studies of the Biological Laboratory, Johns Hopkins University. Baltimore.

Tasca—Texas Academy of Science. Collegiate Academy. Sam Houston State College. Huntsville.

Tex. A. and M. Res. Found.—Agricultural and Mechanical College of Texas Research Foundation. College Station.

Tex. Game and Fish.—Texas Game and Fish. Austin.

Tex. Game, Fish and Oyster Comm.—Texas Game, Fish and Oyster Commission. Rockport.

Tex. Jour. Sci.—Texas Journal of Science. Austin.

Trans. Amer. Fish. Soc.—Transactions of the American Fisheries Society. Ann Arbor.

Trans. Amer. Microsc. Soc.—Transactions of the American Microscopical Society. Columbus.

Trans. Amer. Phil. Soc.—Transactions of the American Philosophical Society. Philadelphia.

Trans. Lit. Phil. Soc. N.Y.—Transactions of the Literary and Philosophical Society. New York.

Trans. No. Amer. Wildlife Conf.—Transactions of the North American Wildlife Conference. Washington.

Univ. Fla. Press—University of Florida Press. Gainesville.

Univ. N.C. Press—University of North Carolina Press. Chapel Hill.

U.S. Bur. Fish. Inv. Rept.—United States Bureau of Fisheries, Investigational Report. Washington.

U.S. Dept. Agric. Bull.—United States Department of Agriculture. Bulletin. Washington.

Va. Acad. Sci.—Virginia Academy of Sciences. Richmond.

Va. Fish. Lab.—Virginia Fisheries Laboratory. Gloucester Point.

Va. Jour. Sci.—Virginia Journal of Science. Lexington.

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